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# LONG TIME TAILS IN DIFFUSION-CONTROLLED RECOMBINATIONS

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CITATION:

Ohtsuki, T.. LONG TIME TAILS IN DIFFUSION-CONTROLLED RECOMBINATIONS. 物性研究 1991, 57(3): 396-396

ISSUE DATE:

1991-12-20

URL:

<http://hdl.handle.net/2433/94844>

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# LONG TIME TAILS IN DIFFUSION-CONTROLLED RECOMBINATIONS

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**Abstract.** Recently, much attention has been paid to slow asymptotic relaxation in simple diffusion-controlled recombination processes. Below an upper critical dimension  $d_c$ , particle densities  $\rho(t)$  exhibit nonanalytic decay in the long time limit  $t \rightarrow \infty$ . Typical examples are

$$A + A \rightarrow \emptyset : \quad \rho_A(t) \propto t^{-d/2} \quad (d < d_c = 2), \quad (1)$$

$$A + B \rightarrow \emptyset \quad (\rho_A(0) = \rho_B(0)) : \quad \rho_A(t) = \rho_B(t) \propto t^{-d/4} \quad (d < d_c = 4), \quad (2)$$

$$A + B \rightarrow \emptyset \quad (\rho_A(0) < \rho_B(0)) : \quad \rho_A(t) \propto \exp[-t^{d/2}] \quad (d < d_c = 2). \quad (3)$$

These behaviors are investigated on the basis of a field theoretical renormalization group technique where initial conditions are taken into account explicitly. It becomes evident that the method is a powerful tool in understanding these phenomena systematically. Complete scaling relations are derived and concrete forms of scaling functions are calculated. Logarithmic corrections at  $d = d_c$  are also discussed.